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- Mathematical Programming

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**Registration:** Tuition, including all course materials and luncheons, is \$195 for the first student and \$175 for each additional student from the same organization. A maximum of forty registrations will be accepted.

**Dr. Walter E. Simonson** is Vice-President of C-E-I-R, Inc. In that capacity his assignments have ranged from design of a real time communication net and display system for network television coverage of a presidential election, to design of an online ordering and inventory system for a major paper manufacturer. His background includes work in systems analysis, computer design, information retrieval, network scheduling, and all other fields including social and behavioral science models. He has a doctorate (communications) from the University of Minnesota, and bachelor's and master's degrees from the same university.



**MR. E. STUART FERGUSON** is a well-known communications consultant. He has been associated with the Harvard College Observatory and the Astrophysical Observatory of the Smithsonian Institution as Project Engineer for the Harvard Radio Meteor Project. He has also been associated with the Defense Department where he engaged in electronics and communication research. He has published numerous professional papers, including several related to Project MAC at MIT. He earned his B.S. in Physics from Columbia University.



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Institute for Advanced Technology  
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## COURSE OUTLINE

### INTRODUCTION

Current interest in real time and its relationship to the main stream of computation—and its future.

Definition of basic terms, including "Terminal Equipment", and a brief background of tele-communications, including telegraph and the development of "Data Communications".

Role of Data Communications in modern computation. The growing Man-Machine relationship, and its inter-dependence on tele-communications and computers.

### The Common Carriers and the Regulatory Agencies.

Communication Media.

Types of Services.

Terminal Devices—

A brief survey of basic terminal equipment types:

1. Keyboard Devices: hard copy  
scope display  
cards, paper tape, etc.
2. Medium and High Speed Printing Devices
3. Special Devices—for example:  
Scope displays with light pens  
Voice answerback systems  
Typical Command and Control Terminals

Some comments on the more exotic techniques:  
OCR, voice and handwriting recognition, etc.

Error Detection and Correction

Data Codes

A brief look to the future

### TERMINAL DEVICES

- a) Low speed, hard copy terminals (tele printers). The role of medium and high speed printers. Paper—its use and misuse.
- b) The role of scope displays of various types.
- c) More detailed discussion of representative special purpose displays.
- d) The future of terminals in a period of growing man-machine interaction.
- e) General discussion on Terminals.

### THE COMMON CARRIERS AND THE REGULATORY AGENCIES

- a) The Bell System and the Independents.
- b) Western Union.
- c) The FCC and State and local agencies.
- d) How do you go about obtaining the services you need?

### COMMUNICATION MEDIA

- a) Principles of Data Transmission—  
Bandwidth and Channel Capacity  
Signal-to-Noise Ratio  
Types of Noise
- b) Transmission Media—  
Cable  
Carrier systems on:  
Cable  
Microwave  
Comsat and others

### TYPES OF SERVICE

Service offerings and their characteristics. For whom are they intended—and what are the economics?

- a) Low Speed Lines (Teletype)
- b) Voice Grade
- c) "Conditioned" Lines
- d) Broadband Transmission ("TELPAK")
- e) Private Wire vs. Switched Services
- f) Data-Phone Service. (A registered service mark of the Bell System)
- g) WATS
- h) Half and Full Duplex

### DATA CODES

How is data encoded for transmission, and what factors should affect selection of a code?

- a) Baudot Based Codes
- b) ASCII
- c) BCD and EBCDIC

### ERROR DETECTION AND CORRECTION

The Philosophy and Economics of Error Control; techniques of error detection and correction. What should the system designer look for?

- a) Hardware Approaches
- b) Software Approaches

### TERMINAL ORIENTED SOFTWARE

What should one expect in manufacturing software to handle data communication chores? How suitable are the major compiler languages for data communication applications?

Criteria  
Cobol, PL/1, Fortran  
Manufacturer packages

### COMPUTING HARDWARE TO LOOK FOR

What should one communication processor?

Input-output Log  
Central Processor

### IMPLEMENTATION

How do real time applications?

Programming  
Systems Design  
Cost Analysis

### Seminar Registration

To register, fill below, clip and payment is made to C-E-I-R, Inc.

Register me for D

NAME: \_\_\_\_\_

TITLE: \_\_\_\_\_

COMPANY: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

PHONE: \_\_\_\_\_

Please Register

NAME: \_\_\_\_\_

TITLE: \_\_\_\_\_

Check Enclosed

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**DATA  
DATA  
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**COMM**



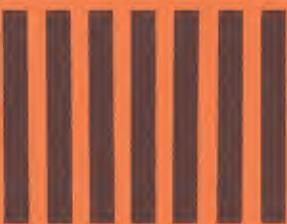
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**C -**

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## YOU NEED TO KNOW

## DATA COMMUNICATIONS

Dear Sir:

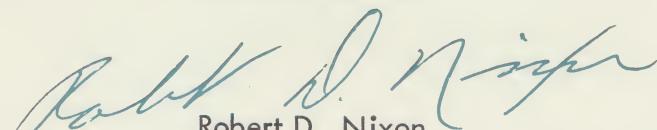
Whether you are involved now in decisions about data communications, or simply realize your need to bone up on this rapidly growing aspect of the data processing business, the "Survey of Data Communications" seminar is important to you.

This seminar is designed to equip you to recognize and deal with the terminal and line problems whose solutions are important to successful systems design. Careful attention is given to the concepts and the terminology of this complex and fascinating field. Though the seminar will not turn you into a communications engineer, it will enable you to talk to one knowledgeably.

C-E-I-R has solid experience in solving the practical problems of making on-line and real time systems work, and work economically. Mr. E. Stewart Fergusson and Dr. Walter E. Simonson, the instructors for this seminar, are prepared to share their hard-won knowledge with you.

Please read the enclosed course outline carefully, there, more effectively stated than anything we can say here, are the reasons why you should mail your registration form today to reserve a place at this seminar.

Sincerely yours,



Robert D. Nixon  
Director